We claim:

1. A process for the continuous preparation of ethylene homopolymers or copolymers in the presence of free-radical polymerization initiators and, if desired, molecular weight regulators at from 120°C to 350°C and pressures in the range from 100 to 4000 bar, in which the polymer is separated from unpolymerized ethylene and if appropriate from comonomers in a high-pressure stage (4a) at a pressure of from 100 to 500 bar and at least one low-pressure stage (4b) at a pressure of from 1 to 100 bar and the ethylene separated off in the high-pressure stage (4a) is separated from remaining monomeric, oligomeric and/or polymeric constituents and recirculated to the inlet of the tube reactor in a high-pressure circuit (9) and the ethylene separated off in the low-pressure stage (4b) is separated from remaining monomeric, oligomeric and/or polymeric constituents and recirculated to the inlet of the tube reactor in a low-pressure circuit (10), wherein the polymerization initiator is used as a solution in an isoparaffinic solvent having a boiling point of not more than 160°C and the solvent is separated from the other monomeric, oligomeric and/or polymeric constituents in the low-pressure circuit (10) and is reused for dissolving initiator.

2. A process as claimed in claim 1, wherein the solvent is separated off in the low-pressure circuit (10) by means of at least a first gas-liquid separator and a last gas-liquid separator connected in series (5a, 5b, 5c, 5d), with the temperature being reduced from separator to separator so that the other monomeric, oligomeric or polymeric constituents are separated out in the first separator or separators (5a, 5b, 5c) and the solvent is separated out as liquid essentially in the last separator (5d).

3. A process as claimed in claim 1 or 2, wherein the isoparaffinic solvent has a boiling point of not more than 150°C, preferably not more than 135°C.

4. A process as claimed in any of the preceding claims, wherein the solvent which has been separated off is used without further purification for dissolving initiator.

5. A process as claimed in any of claims 2 to 4, wherein the pressure upstream of the last separator is increased to such an extent that the solvent condenses while the ethylene is present in gaseous form.

6. A process as claimed in any of the preceding claims, wherein the isoparaffinic solvent has a spontaneous ignition temperature in accordance with DIN 51794 of at least 250°C, in particular at least 300°C.

7. A process as claimed in any of the preceding claims, wherein the solvent used is a mixture of isoparaffins having a boiling range from 100 to 150°C, in particular from 110 to 140°C.

8. An apparatus for the high-pressure polymerization of ethylene and, if desired, comonomers, comprising

a) a high-pressure tube reactor (1) which has at least one feed point for the monomer and at least one feed point (12a, 12b, 12c) for a solution of polymerization initiators,

b) at least one mixing vessel (13a, 13b, 13c) for dissolving the polymerization initiators in an isoparaffinic solvent having a boiling point of not more than 160°C, which is connected to the feed point or points (12a, 12b, 12c),

c) a high-pressure stage (4a) and at least one low-pressure stage (4b) for separating unpolymerized reaction constituents from the polymer product,

d) a high-pressure circuit (9) for recirculating the monomer separated off in the high-pressure stage (4a) to the inlet of the tube reactor (1),

e) a low-pressure circuit (10) for recirculating the monomer separated off in the low-pressure stage (4b), which circuit comprises at least one first separator (5a, 5b, 5c) for separating the other reaction constituents from the monomer and solvent and a last separator (5d) for separating the solvent from the monomer, with heat exchangers (8c, 8d, 8e) being provided between the separators (5a, 5b, 5c, 5d), and

f) a return line (14) for recirculating the solvent from the last separator (5d) to the mixing vessel or vessels (13).

9. An apparatus as claimed in claim 5, wherein a collection vessel is provided between return line (14) and mixing vessel(s) (13a, 13b, 13c).